Information Fusion for Enhanced Aircraft Engine Health Management

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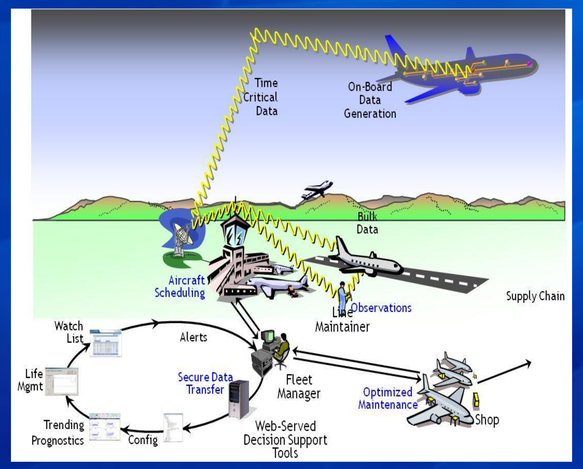
Description

The objective of this effort is to develop a generic and modular architecture and supporting analytic methods for diagnostic *information fusion* for aircraft gas turbine engines. To accomplish this it is necessary to identify and acquire actual engine test data & information sources, identify system level information fusion scenarios, and develop, verify and validate necessary analysis methods & tools.

Benefits

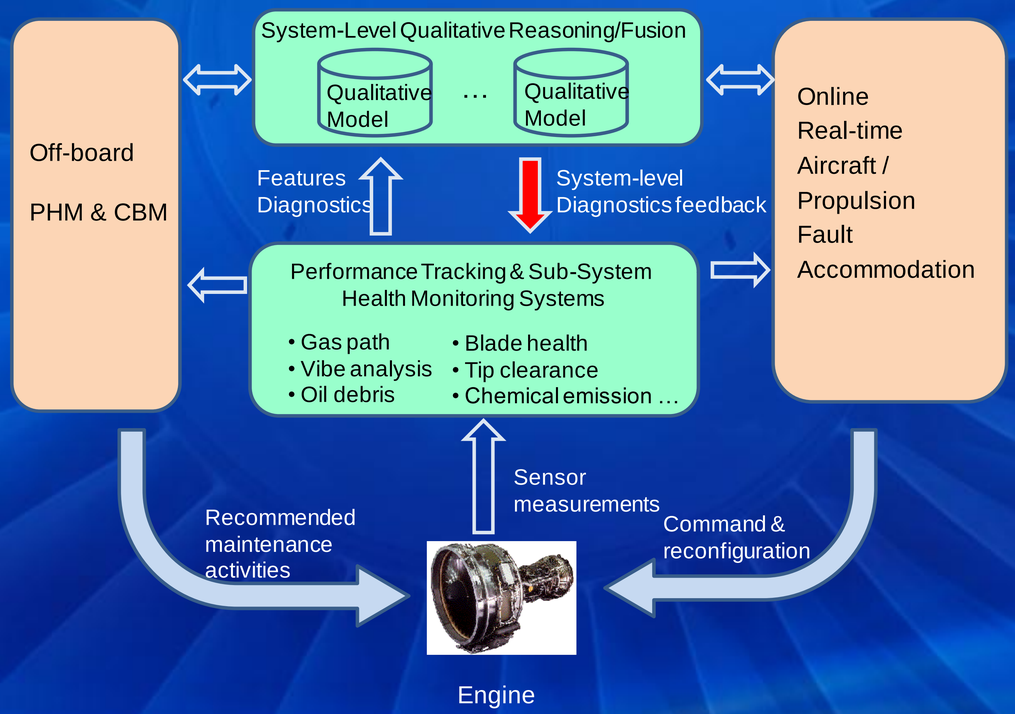
Information fusion is a pivotal element for achieving the benefits of Engine Health Management (EHM), in particular, increasing propulsion operational reliability. Leveraging all available information, on-board and off-board, is *key* to ensuring EHM success, which in turn will positively impact aviation safety.



Approach

Information is more than just data. It encompasses measured sensor data from a variety of sources but also includes our domain knowledge of propulsion operation and control, models, constraints, assumptions, and negative information (i.e., what you don't observe). Our approach was to define a system level architecture to leverage all information sources ,on-board and off-board, and develop a combination of model-based, empirical, and intelligent methods to demonstrate effective use of this information.

The NASA CMAPSS simulation was used, driven by real FOQA data, (in part of this development), to provide verification of some new algorithms. C17 VIPRI and II data was then applied for preliminary validation. Potential fusion scenarios using gas path, emissions, humidity , vibration, oil system sensors etc, were cataloged for subsequent investigation.

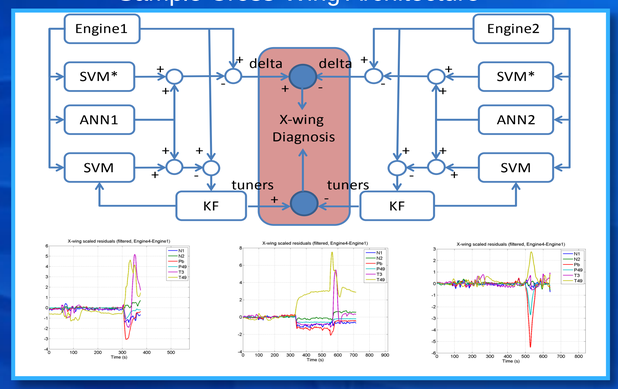


Recent Results

Some of the accomplishments made during this project include:

- EGT profile analysis for anomaly detection.
- Derivation of humidity corrections to reduce gas path measurement uncertainty.
- Development of a fusion scenario catalog.
- Cross-Wing gas path anomaly detection system for *transient* engine operation.
  - Potential False Alarm Reduction demonstrated with VIPR data

Sample Cross-Wing Architecture



Future Work/References

- Continue Development with VIPR and other available data
- Provide (VIPR driven) Fusion software demonstration

Volponi, A.J, 2005, Data Fusion for Enhanced Aircraft Engine Prognostics and Health Management`, NASA Report CR-2005-214055, Glenn Research Center, December 2005.

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